MONTECH®

Handling Components

SERVOLINE

USER MANUAL
SERVO AMPLIFIER
Version I/O

BA-100039

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Change index

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1. General

1.1 Introduction

This Manual explains the installation, wiring and interfaces of the digital servo amplifier (version I/O). The information is broadly arranged as follows:

- Chapter 1: General information
- Chapter 2: Behaviour of the servo amplifier
- Chapter 3: Installation
- Chapter 4: Interfaces

This manual forms part of the complete documentation of the SERVOLINE® products. The complete documentation consists of the following documents:

Description	Ref. No
• Connection to automation systems (version I/O)	BA-100038
• Setup software (version I/O)	BA-100040
• Servo amplifier (version I/O)	BA-100039
• Mechanical design of the SERVOLINE® products	miscellaneous

The documentation is available in the following language versions: German, English, French, Italian, Spanish and Swedish.

1.2 Scope of delivery of servo amplifier

- User manual for servo amplifier version I/O
- Servo amplifier SR600
- I/O extension card (mounted)
- Counterplug X3, X4, X0A, X0B, X7, X8, X11A and X11B

1.3 Dangers and safety information

The servo amplifier may be operated **only** in a closed switch cabinet taking into account the ambient conditions defined in "Technical Data".

The servo amplifier may be operated only on the three-phase, earthed industrial network (TN network, TT network with earthed neutral).

When the servo amplifier is used in the residential area, in business and commercial areas and in small companies, additional filter measures must be taken by the user.

- **Only properly qualified personnel are permitted to perform activities such as installation, setup and maintenance.** Properly qualified persons are those who are familiar with the assembly, installation, setup and operation of the product, and who have the appropriate qualifications for their job. The qualified personnel must know and observe the following standards or guidelines:

  IEC 364 and CENELEC HD 384 or DIN VDE 0100
  IEC report 664 or DIN VDE 0110
  National accident prevention regulations or VBG4

- Servo amplifiers must not be opened. Keep all covers, protective devices and switchgear cabinet doors closed during operation. There is a danger of life-threatening or severe personal injuries or material damage.

- Servo amplifiers contain electrostatically sensitive components which can be damaged by incorrect handling. Avoid contact with highly insulated materials (artificial fabrics, plastic films etc.). Place the servo amplifier on a conductive surface.

- **Never** undo the electrical connections to the servo amplifier while it is live. There is a danger of electric arcing with damage to contacts and danger to persons.

- During operation, servo amplifiers, according to their degree of enclosure protection, may have uncovered live components. Control and power connections may be live, even if the motor is not rotating.

- After disconnecting the servo amplifier from the mains supply voltage, wait at least two minutes before touching any live sections of the equipment (e.g. contacts) or undoing any connections. Capacitors can still have dangerous voltages present up to five minutes after switching off the supply voltages. To be sure, measure the voltage in the DC-link circuit and wait until it has fallen to below 40V.

1.4 CE conformance declaration (to MRL Appendix II A)

Conformance with the EC Directive on EMC 89/336/EEC and the Low Voltage Directive 72/23/EEC is mandatory for the supply of servo amplifiers within the European Community.
The servo amplifiers have been tested by an authorized testing laboratory in a defined configuration with the system components which are described in this documentation.

Determinations and standards taken into account:
- **EC Directive on EMC 89//336/EEC**
- **Low Voltage Directive 73/23/EEC**

1.5 UL and cUL conformance

UL (cUL)-certified servo amplifiers (Underwriters Laboratories Inc.) fulfil the relevant US and Canadian standards (in this case UL 840 and UL 508C). UL (cUL) certification relates entirely to the mechanical and electrical design and construction of the servo amplifier.

UL 508C describes fulfilment by the design, of minimum requirements for electrically operated power conversion equipment such as frequency converters and servo amplifiers, which is intended to eliminate the risk of fire being caused by this product.

UL 840 describes the fulfillment by design of air and insulation creepage spacings for electrical equipment and printed circuit boards.

Determinations and standards taken into account:
- **UL 508C**
- **UL 840**

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1.6 Product description and application

Servo amplifiers are components of the servo axes SHA, SVA and the servo cartensian system SFP which are intended to be incorporated into industrial equipment.
The digital servo amplifier is required for position-controlled operation of the servoline products SHA, SVA and SFP. Operation of the servo amplifier is through the serial interface of a personal computer (PC) running the supplied operator software.
When servo amplifiers are installed in machines or plants, the intended operation of the amplifier is prohibited until it has been established that the machine or plant fulfills the requirements of the EC Directive on Machines 89/392/EEC and the EC Directive on EMC (89/336/EEC). EN 60204 and EN 292 must also be observed.
In connection with the Low Voltage Directive 73/23/EEC, the harmonized standards of the EN 50178 series are applied to the amplifiers, together with EN 60439-1, EN 60146 and EN 60204.
The manufacturer of the machine or plant is responsible for ensuring that they meet the limits which are required by the EMC regulations. This documentation contains advice on the correct installation for EMC, such as shielding, grounding, and the laying out of cabling.

The equipment manufacturer is obliged to prepare a hazard analysis of the equipment, and is also responsible for functional, mechanical and personal safety aspects in relation to the machine.
The servo amplifiers are installed as components in electrical installations or machines and may be put into operation only as integrated components of the installation.

The BTB contact must be wired into the safety loop of the system. The safety loop as well as the stop and emergency stop functions must comply with the requirements of EN60204, EN292 and VDI2853.

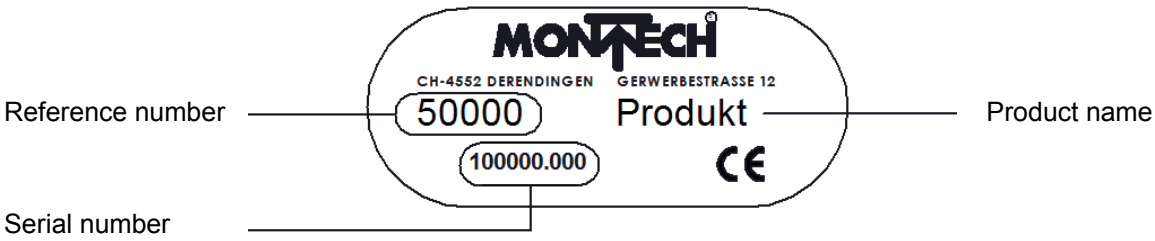
Before operating the servo axes, all work is to be carried out as specified in the operator manuals of the servo amplifier and the Servoline axes. Strictly observe all safety regulations.

- Assembly, installation, wiring and **final check have been carried out according to the operator manual for the servo amplifier.**
- Assembly, installation, wiring and **final check have been carried out according to the operator manual for the servo axes.**

1.7 Additional information

The aim of the present User Manual is to enable users to employ the servo amplifier correctly and safely. Should further information be required in relation to your particular application, please contact the manufacturer.
When reordering User Manuals, it is essential to quote the reference number, the product name and serial number.
This document can be obtained from our homepage www.montech.com.

Fig.1



Montech AG
Management

U. D. Wagner C. Wullschleger

1.8 Validity of the User Manual

Our products are continually updated to reflect the latest state of the art and practical experience. In line with product developments, our User Manuals are continually updated.
Every User Manual has an order number (e.g. BA-100039) and an edition number (e.g. 03/2008). The order number and the addition number are shown on the title page.

1.9 Technical data

Voltage supply			3 x 230V $_{(-10\%)}$ ... 480V $_{(+10\%)}$; 50Hz ... 60Hz
Rated power (S1 operation)			1 kVA
Fuse for AC supply FN1/2/3			6 AT (max. 20AT)
Interference suppression filter for power supply			integrated (Class A)
Auxiliary voltage supply SHA, SFP, SHE (without holding bracke)			24 VDC (-0% + 15 %); 1A
Auxiliary voltage supply SVA, SVE (with holding bracke)		1)	24 VDC (-0% + 15%); 3A
Fuse for 24 V supply FH1/2			max. 16 AF
Interference suppression filter for auxiliary voltage supply			integrated (Class A)
Digital control inputs			low 0 ... 7V / high 12 ... 36V / 7mA, PLC-compatible
Number of digital inputs		1)	4
Number of digital inputs for extension card		2)	14
Digital signal outputs			Open-Collector, max. 30VDC, 10mA
Number of digital outputs		1)	2
Digital signal outputs for extension card			24V / max. 500mA, PLC-compatible
Number of digital outputs for extension card		3)	8
Number of storable drive records			EEPROM 180
Overload monitoring			I^2t
Acceleration ramps			$sine^2$
Input mode of the target positions (PC)			Teach-in, jogging mode or direct numerical input via PC keyboard
Connections of control signals			1 x Combicon, 18 polig / 2x Mini Combicon, 12-pole
Connections of the power signals			Power Combicon 4x4 + 1x6-pole
Resolver input connection			SubD 9-pole (jack)
PC interface			SubD 9-pole (plug)
Own weight		[kg]	2.5
Ambient conditions:	Temperature	[°C]	0 ... 55
	Rel. humidity		< 85% non-condensing
	Air purity		Contamination level 2 according to EN60204 / EN50178
Servo regulator protection category			IP 20
Servo regulator installation			Vertical (switch cabinet)
Dimensions (HxWxD) without plug		[mm]	275 x 70 x 265
Warranty period			2 years, beginning with date of delivery

1) Configurable
2) Specified functions: Drive order numbers 2^0 to 2^7, scanning of reference switches, acknowledge errors, reset, various start commands
3) Specified functions: In position, lag error, exceeding a position, failing to reach a position

1.9.1 Function

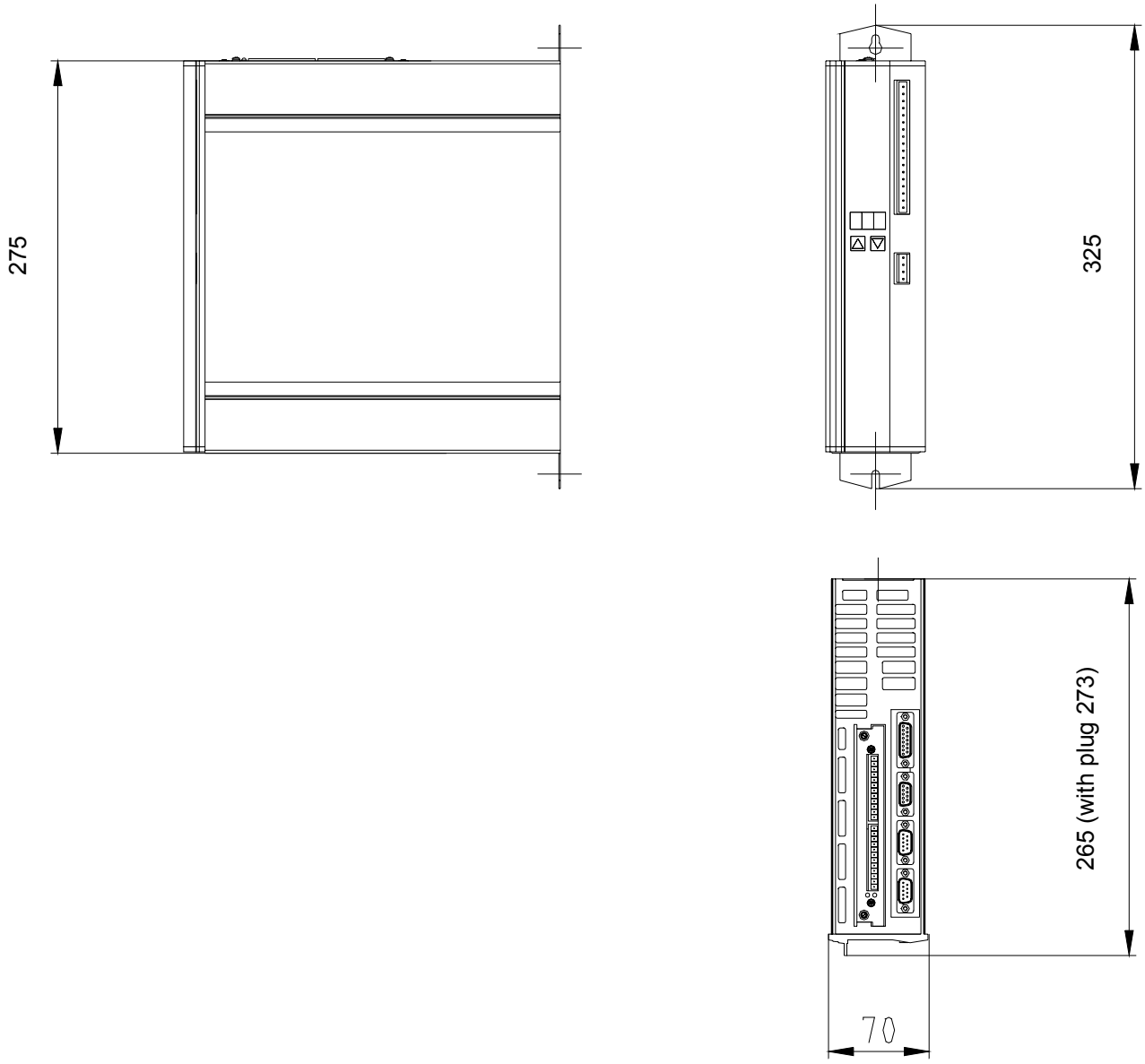
The servo regulator is adapted before delivery to the corresponding linear axis and forms part of its scope of delivery. The servo amplifiers are delivered with installed I/O extension card as standard.

The drive orders stored in the EEPROM of the servo regulator can be selected and started via the digital inputs. Reaching of the target position is indicated via a digital output. All important functions of the position controller can be triggered via a small, manufacturer-independent control.

1.9.2 Modes

Integrated position controller	• Execute drive orders • 180 drive orders storable in the EEPROM • Concatenation of drive orders • Absolute and relative travel • Reference travel • Jogging mode • Teach-In of position values • 4 position registers (signal thresholds, cam function) • Software limit switch • Lag error window adjustable • Window for InPosition signal adjustable • Sine^2 acceleration and deceleration ramps • I^2t overload monitoring
Master-slave operation	• 1 master, up to 16 slaves • Resolution (translation) adjustable
Encoder emulation	• ROD426-compatible (dec./bin.) • SSI (grey/binary)

1.9.3 Dimensions

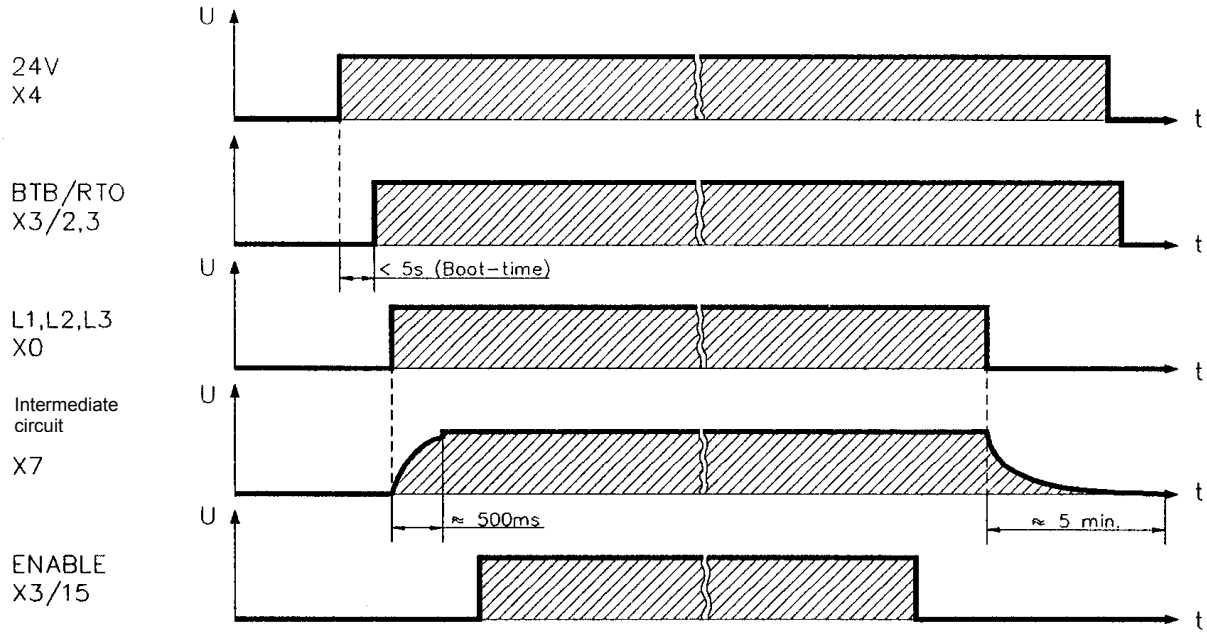


2. Behaviour of the servo amplifier

2.1 Switch-on and switch-off behavior

The diagram below illustrates the correct functional sequence for switching the servo amplifier on and off.

Fig.3



2.2 **Emergency stop function** according EN60204 (VDE 0113)

The emergency stop function is defined by EN 60204 (VDE 0113), Paragraph 9.2.5.4. It is used for stopping the servo axis as quickly as possible in the event of danger.

- The emergency stop function must be capable of being triggered by handling by a single person. The emergency stop function must always be ready for operation and available. The user must not be required to think about the effect of this device.
- The use of servo horizontal axes SHA, servo vertical axes SVA and servo two-dimensional portals SFP in installations is permissible only when they are secured by means of **movable, separating safety devices according to EN 292-2, Section 4.2.2.3**.
- In the case of an internal fault in the servo amplifier, the motor can no longer be operated in a controlled manner but becomes torque-free and revolves to a stop. All axes are however equipped with damped stops which absorb the resultant energy.

Realization of the emergency stop function according to EN 60204 (VDE 0113) Category 1:

Stoppage of the motor by disconnection of the enable signal (terminal X3/15) and the mains supply (L1, L2, L3) and controlled electronic braking. **The 24 V voltage supply must be maintained**.

The elimination of the enable signal and of the power supply during traversing leads to emergency braking. The drive brakes with the set emergency braking ramp and remains stationary in the torque-free state.
The vertical axes have a holding brake. If the speed has fallen below 3% of the maximum traversing speed, the holding brake is activated by switching off its voltage supply, and the output stage is disabled 100 ms later. The dropin delay time of the holding brake is 5 to 10 ms.

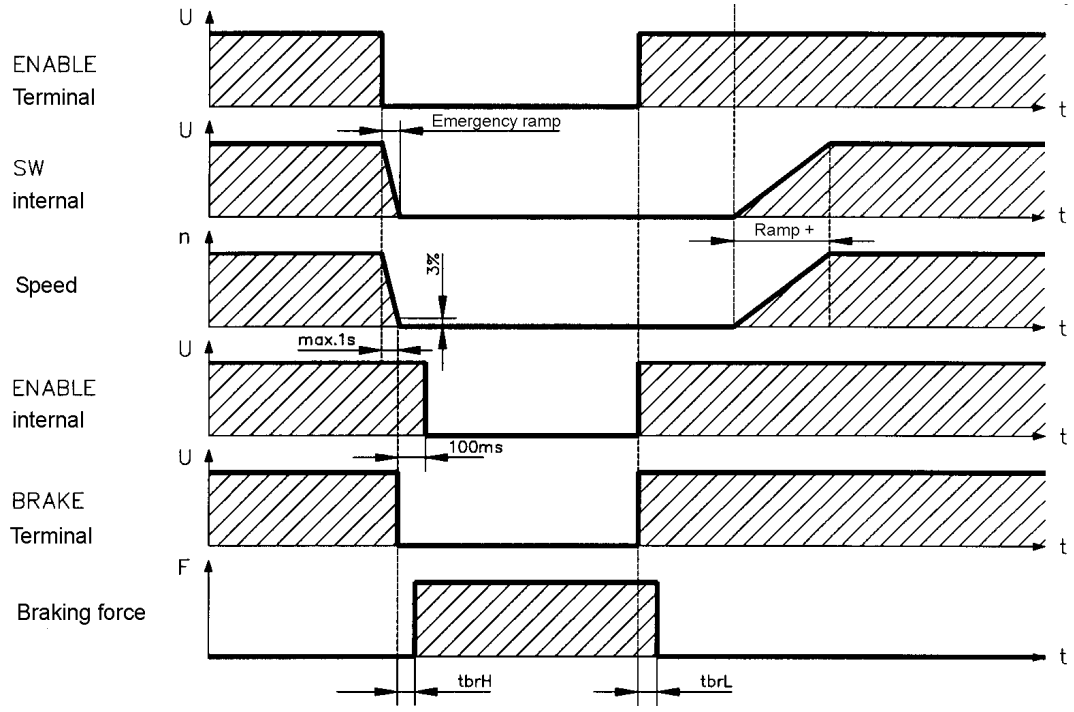
Restarting:
After the problem which led to the emergency stop situation has been solved, the mains supply must be connected. If an error message is present, the servo amplifier must be reset. No drive order can be executed without a prior reset and subsequent reference travel.

2.3 Motor holding brake (only SVA-130 and SVE-130)

The holding brake installed in the motor is actuated directly by the servo amplifier. In the diagram shown below, the relationship between ENABLE signal, speed and braking power in terms of time and function is shown.

Caution!

- **Actuation of the motor holding brake constitutes a risk to person safety!**



During the internal ENABLE delay time of 100 ms, the setpoint speed value of the servo amplifier is brought internally to 0 V with the emergency braking ramp. On reaching 3% of the set final speed or after 1 s at the latest, the brake output switches.

Technical data

Connected voltage	24 VDC (0% + 15%) Terminal X4
Electric power	8 W
Air delay time tbrH	15 – 20 ms
Activation delay time tbrL	5 – 10 ms

3. Installation

3.1 Procedure

The following information is intended to assist with the installation and wiring in an expedient order without important points being forgotten. The individual points are described in the stated sections.

Site	In a closed switchgear cabinet. The site must be free from conductive or corrosive materials.	➔ Chapter 1.10 ➔ Chapter 3.2
Ventilation	Check that the ventilation of the servo amplifier is unimpeded and keep within the permitted ambient temperature. Keep the required space clear above and below the servo amplifier.	➔ Chapter 1.10 ➔ Chapter 3.2
Assembly	Assemble the servo amplifier and power supply close together on the conductive **earthed** mounting plate.	➔ Chapter 3.2
Cable selection	Select cables according to EN 60204.	➔ Chapter 3.4
Grounding Shielding	EMC-conform shielding and grounding. Earth the mounting plate and CNC-GND of the controls.	➔ Chapter 3.6, 3.7, 3.8
Wiring	• **Route power leads and control cables separately** • **Wire the BTB/RTO contact in series into the safety loop of the installation.** • Connect the digital control inputs to the servo amplifier • Connect the resolver cable • Connect the expansion card • Connect the reference switch • Connect the power lead to the motor • Connect the 24V auxiliary voltage (observe max. permissible voltage values) • Connect the main voltage (observe max. permissible voltage values) • **Mount plug X8 ballast bridge**	➔ Chapter 4
Final check	Carry out a final check of the wiring installed according to the appropriate wiring diagram.	→ Chapter 3.6, 3.7, 3.8

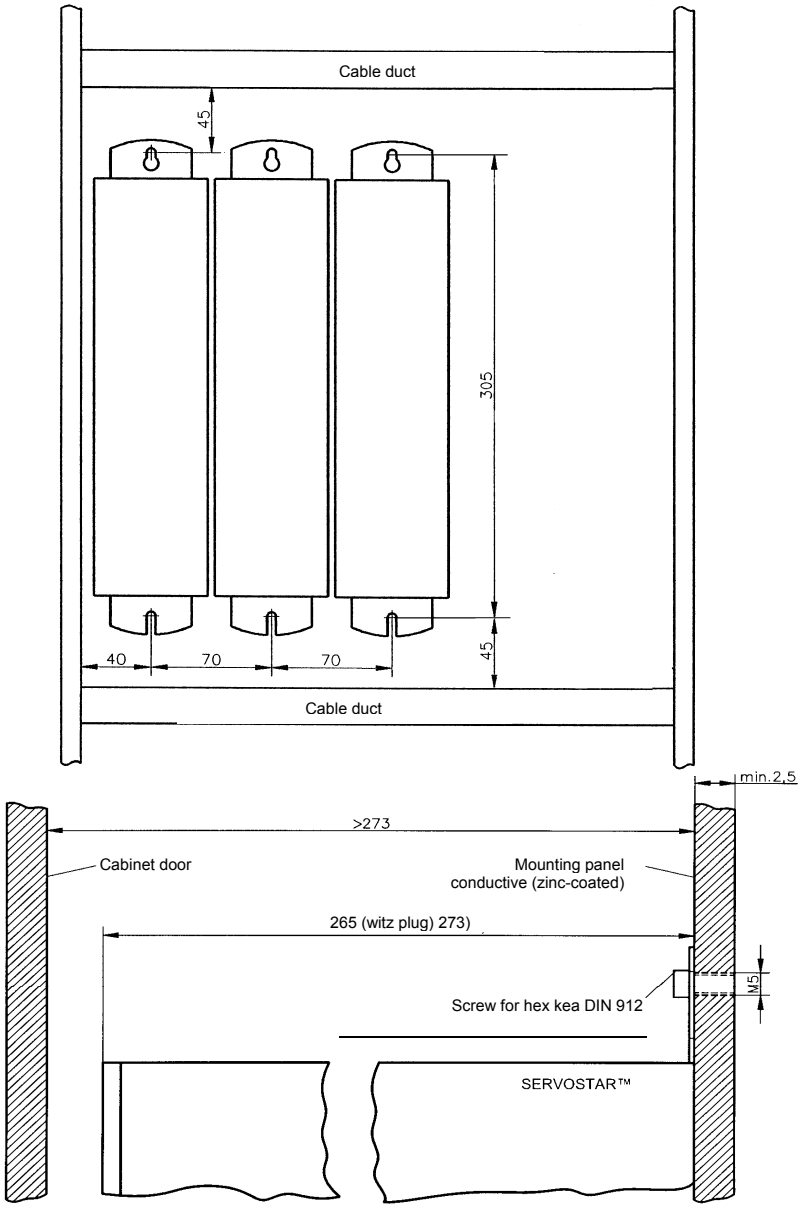
3.2 Assembly

- Protect the amplifier from impermissible stresses. In particular, do not let any components become bent or any insulation distances altered during transport and handling. Avoid contact with electronic components and contacts.
- Take care that the servo amplifier and motor are properly earthed. Do not use painted (non-conductive) mounting plates.

The servo amplifier is installed vertically onto a conductive, **earthed** (galvanized) mounting plate (Fig. 4) in the switchgear cabinet. Assemble the servo amplifier and the power supply (24V) close together on the conductive, **earthed** mounting plate. Keep the required space clear above and below the servo amplifier. Ensure that there is an adequate flow of cool, filtered air into the bottom of the switchgear cabinet.

It is imperative that the servo amplifier be properly earthed in the switchgear cabinet with the PE rail as a reference potential. Without low-resistance earth connection, personnel safety cannot be ensured.

Fig. 4



3.3 Wiring

Only professional staff who are qualified in electrical engineering are allowed to install the servo amplifier.

Instructions

- **Check the combination of servo amplifier and servo axis**. Compare the serial numbers. The serial number of the servo amplifier is located on the front panel (➔ Chapter 1.8), For location of the serial number of the servo horizontal axis, refer to the user manual of the servo horizontal axis (Chapter 1.8).
- The ground symbol ⏚ in the wiring diagrams indicates that you must take care to provide an electrically conductive connection with the largest possible area between the unit indicated and the mounting plate in the switchgear cabinet. This connection is for the effective grounding of HF interference. Do not confuse the ground symbol with the PE-symbol ⏚ (a protective measure according to EN 60204).
- Ensure that the max. permissible rated voltage at the connections L1, L2, L3 or +DC, — DC is not exceeded by more than 10% even in a worst-case scenario (see EN 60204-1 section 4.3.1). Excessive voltage at these connection can result in the servo amplifier being destroyed.
- Use the servo amplifier only on earthed three-phase mains supply networks for operation with the servo horizontal axes SHA.
- Fusing of the AC supply input and the 24V supply is to be installed by the user (➔ Chapter 3.5).
- Route power and control cables separately. We recommend a separation of at least 20 cm. This improves the interference immunity required by EMC regulations.
- Install all heavy-current cables with an adequate cross-section, to EN 60204 (➔ Chapter 3.4).
- Wire the BTB/RTO contact in series into the safety circuit of the installation. Only in this way is the monitoring of the servo amplifier assured.
- It is permissible to alter the servo amplifier settings by using the operator software. Any other alterations will invalidate the warranty.

Caution!

- **Only install and wire up the equipment when it is not live**, i.e. when neither the mains power supply nor the 24V auxiliary voltage nor the operating voltages of any other connected equipment are switched on.
- Take care that the cabinet is safely disconnected (with a lock-out, warning signs etc.)
- The individual voltages will be switched on for the first time during commissioning.
- Never disconnect the electrical connections to the servo amplifier while they are live. In unfavorable circumstances this could result in the destruction of the electronics. Residual charges in the capacitors can have dangerous levels for up to 300 seconds after switching off the mains supply voltage. Measure the voltage in the DC link (+DC/-DC) and wait until the voltage has fallen below 40V. Control and power connections can still be live, even when the motor is not rotating.

3.4 Conductor cross-sections

In line with EN 60204, we recommend the following for **single-axis systems**:

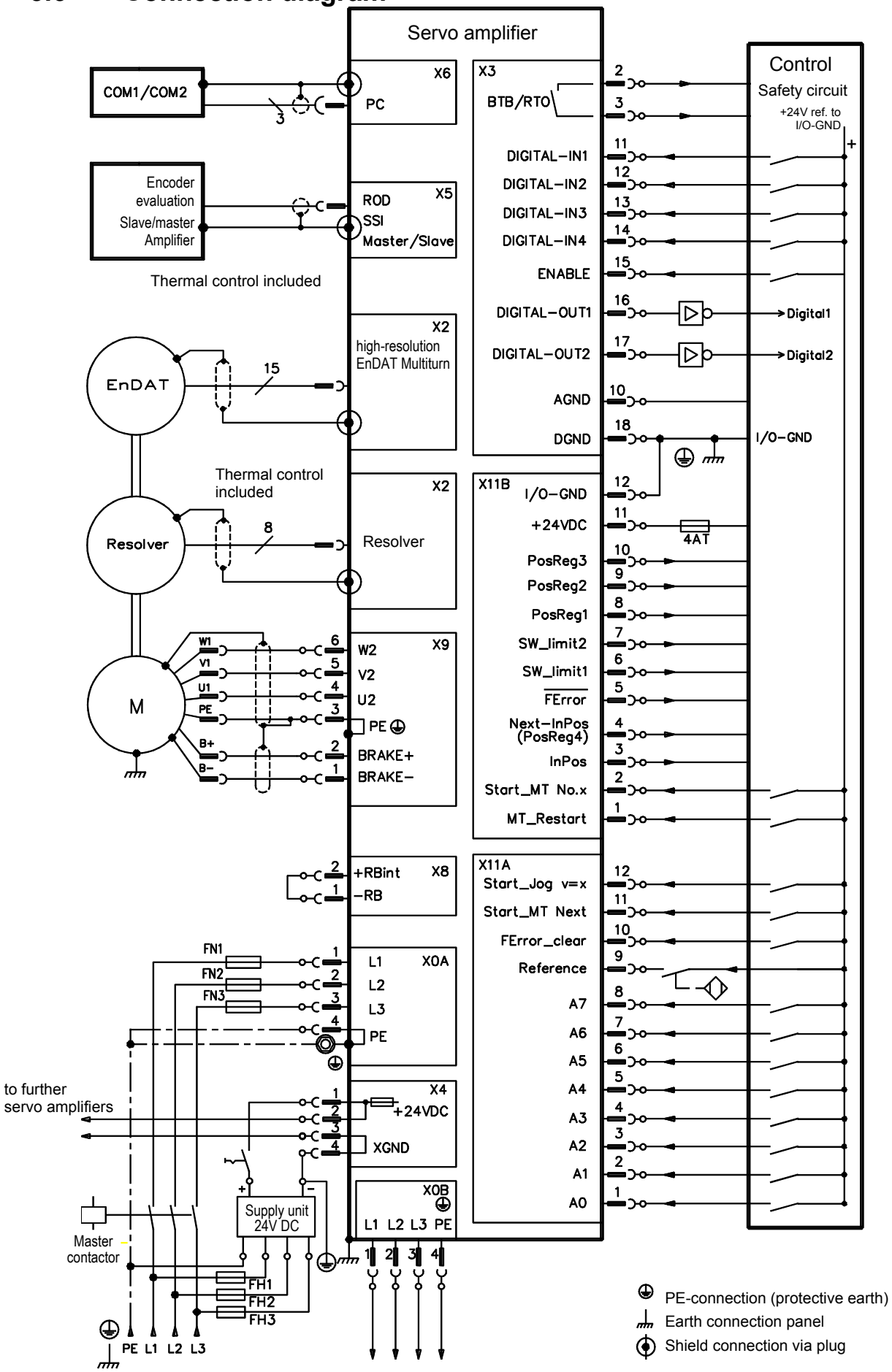
AC connection	1.5 mm²
DC link	1.5 mm²
Motor cables up to 25 m length	use motor cable supplied (1.5 mm². shielded)
Resolver, thermostat-motor	use resolver cable supplied (0.25 mm² twisted pairs, shielded)
Control signals, BTB, DGND	0,5 mm²
+24 V / XGND	max. 2,5 mm², check voltage drop

3.5 External fusing

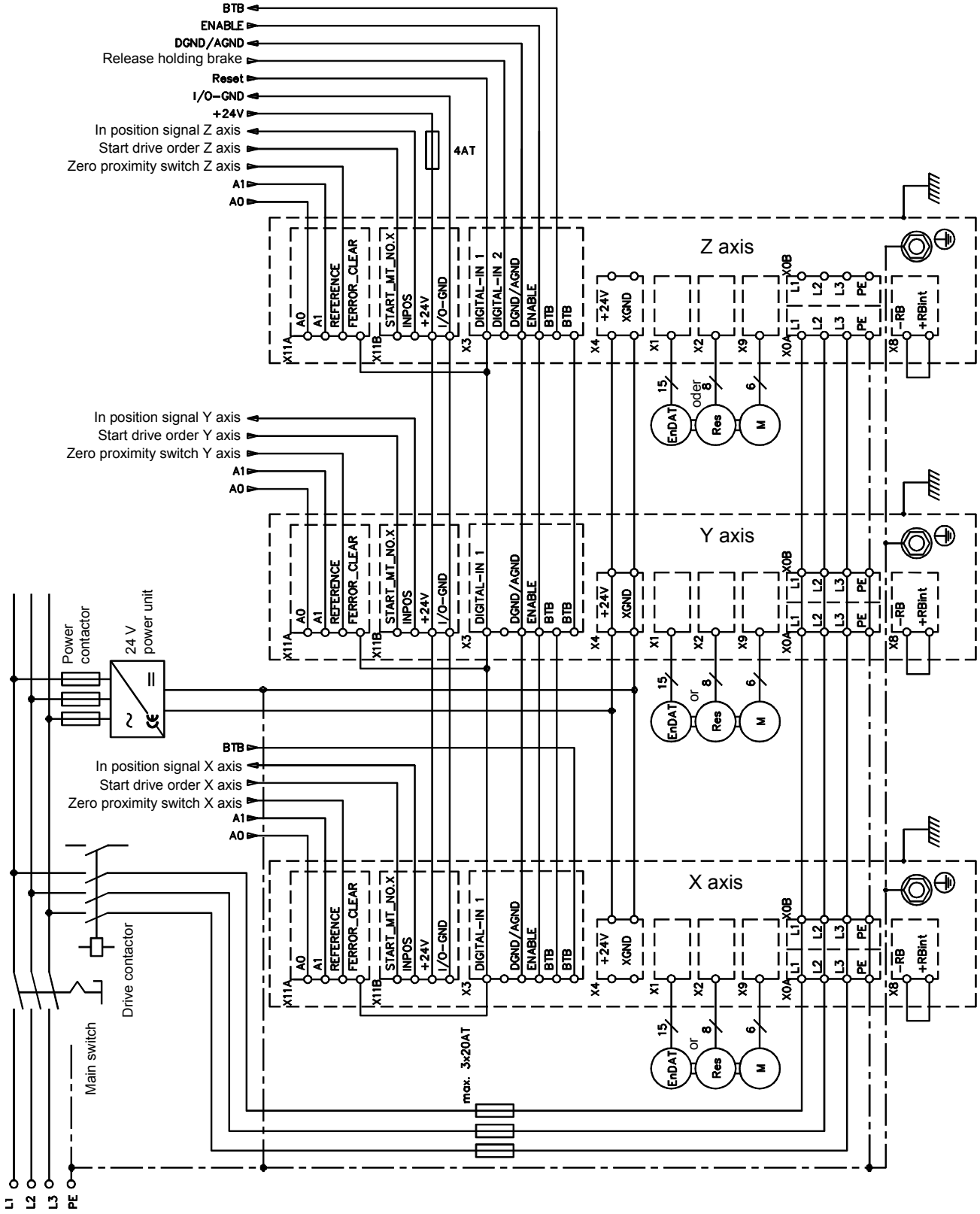
Fusible cutouts or similar

AC-supply FN1/2/3	6 AT (max. 20AT)
24V-supply FH1/2	max. 16 AF

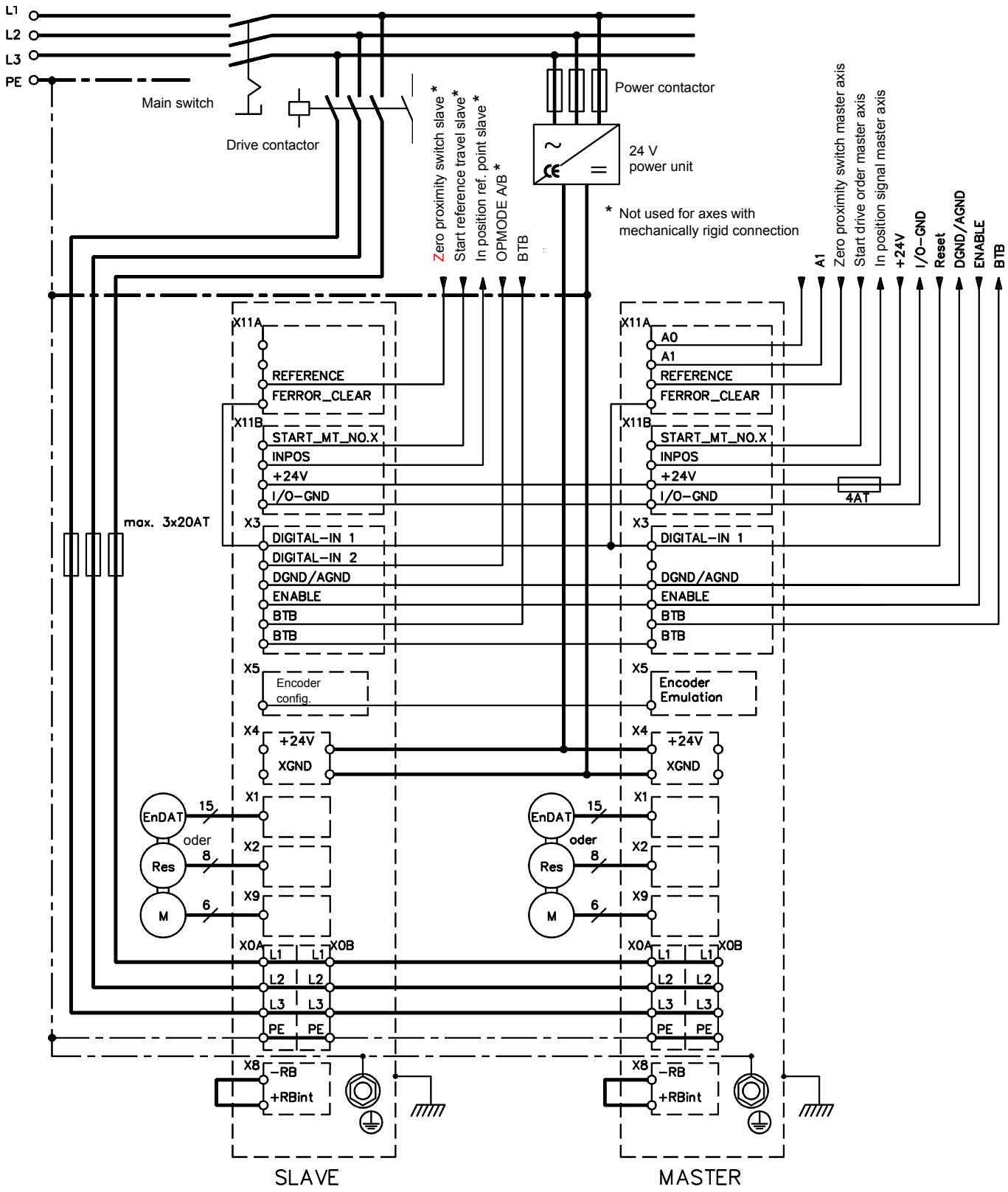
3.6 Connection diagram



3.7 Connection example for multi-axis system

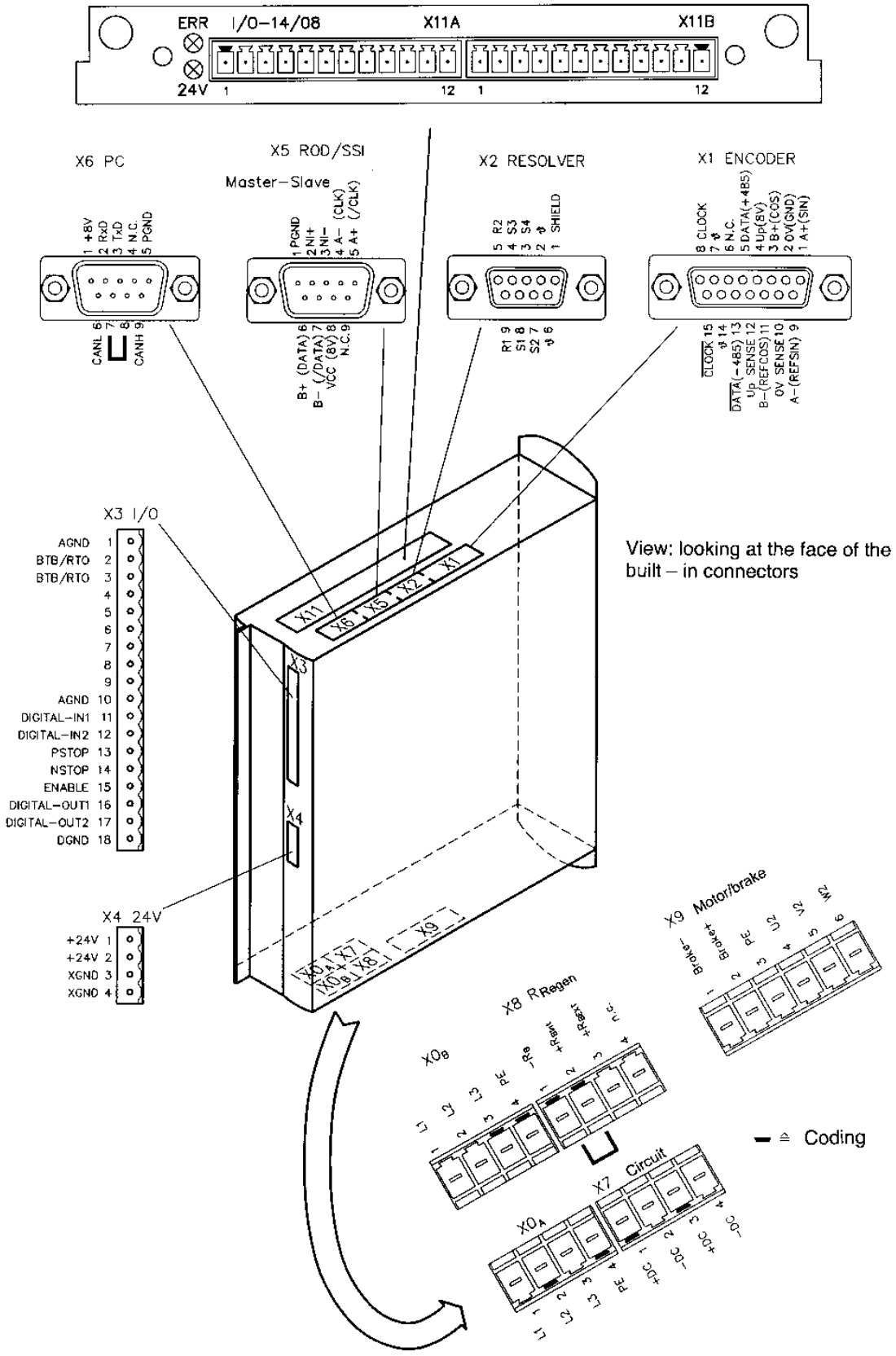


3.8 Connection example for master-slave system



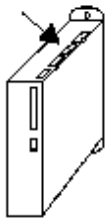
4. Interfaces

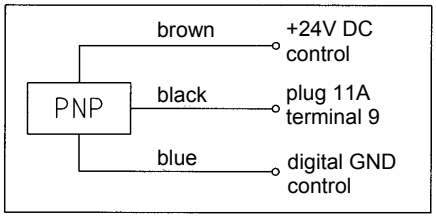
4.1 Pin assignments



4.2 Reference switch

The length of the cable of the supplied inductive proximity switch is 5 m.
Wiring of the proximity switch is according to the following diagram. After wiring, check the function of the proximity switch.

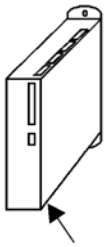


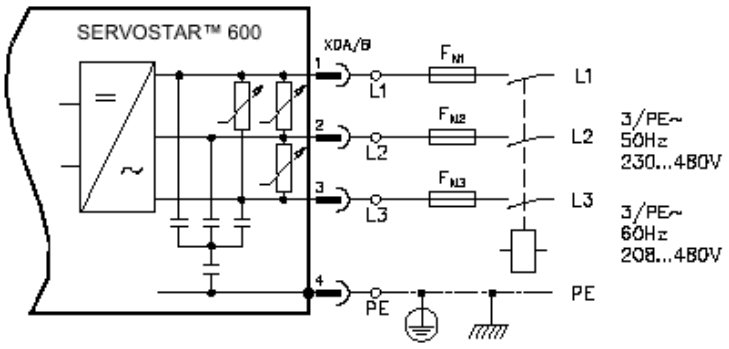


4.3 Voltage supply

4.3.1 Mains connection (X0)

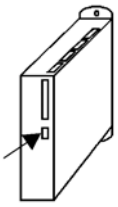
- Directly to earthed 3~ supply, 400V, 50Hz, filter Class A integrated.
- Fusing 6AT (e.g. fusible cut-outs provided by the user).

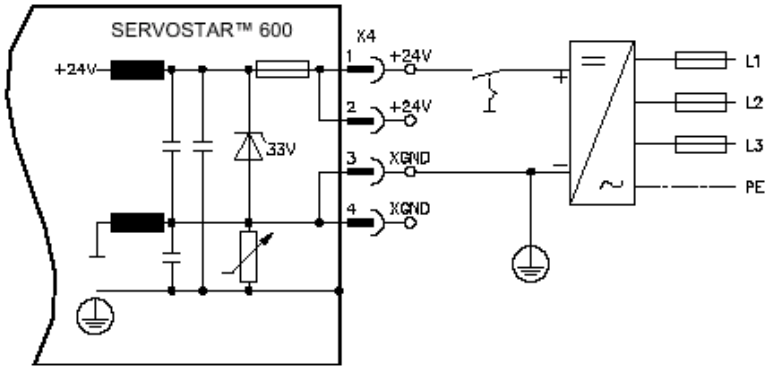




4.3.2 24V auxiliary supply (X4)

- Electrically isolated, external 24 DC supply, e.g. with insulating transformer.
- Required current rating 1A, voltage 24V (-0% + 15 %) without holding bracke.
- Required current rating 3A, voltage 24V (-0% + 15 %) with holding bracke.
- Integrated EMC filter Class A for the 24V auxiliarysupply 24V auxiliary supply.

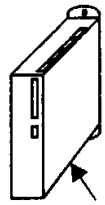


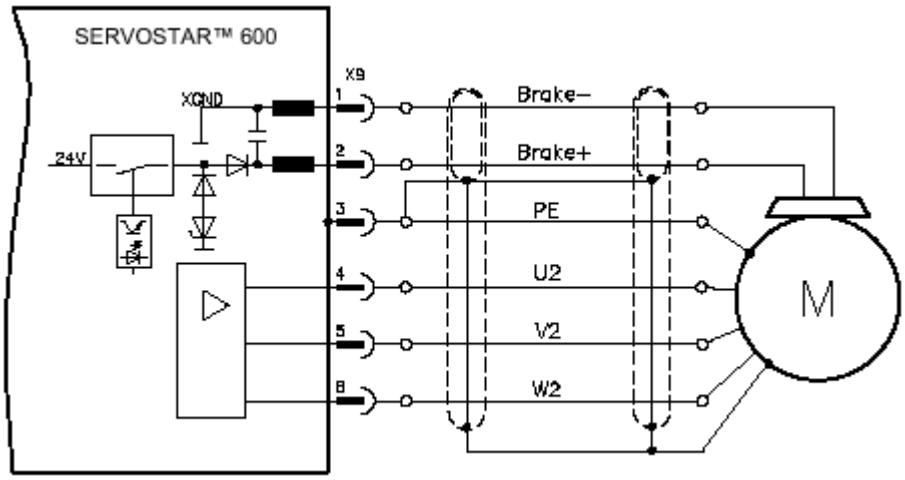


4.4 Motor connection (X9)

Use the connecting cable supplied. The connecting cable is shielded and capable of following.
The brake wires are used only with the use of a servo vertical axis.

Cores	mm^2	(4x1.5 + (2 x 0,75))
Operating temperature range	°C	-10 / +80
Outside diameter	mm	11.5
Min. bending radius	mm	120
Connecting plug	Motor	1x6-pole, $4mm^2$
	Amplifier	Power Combicon 7.62





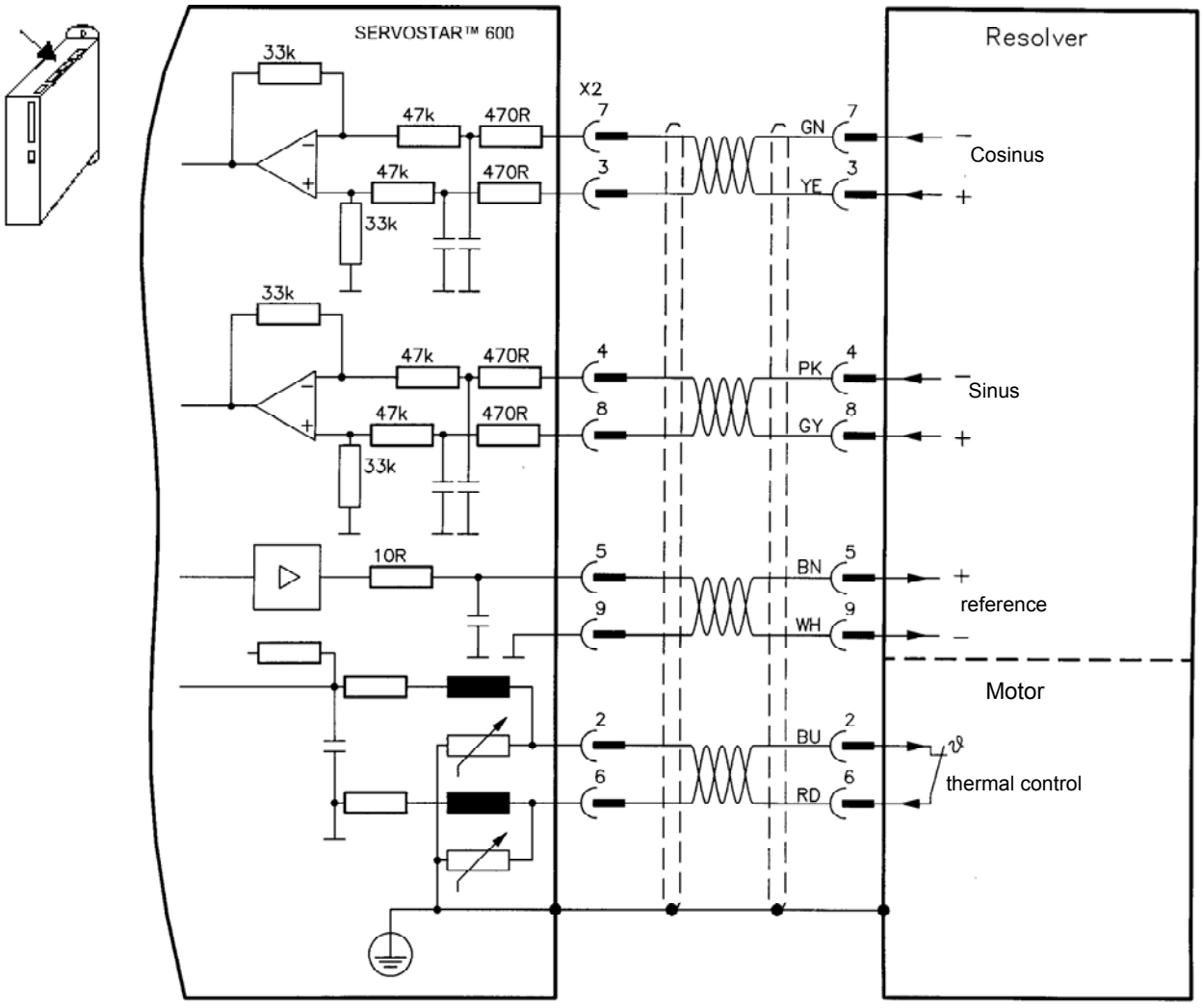
4.5 Feedback

4.5.1 Resolver connection (X2)

The resolver cable transmits the signals of the two-pole hollow-shaft resolver and the thermostat contact.

Use the connecting cable supplied. The connecting cable is shielded and capable of following.

Cores	mm^2	4x2x0.25
Operating temperature range	°C	-30 / +80
Outside diameter	mm	6.9
Min. bending radius	mm	60
Connecting plug	Motor	18-pole, $2.5mm^2$
	Amplifier	SubD 9pol.

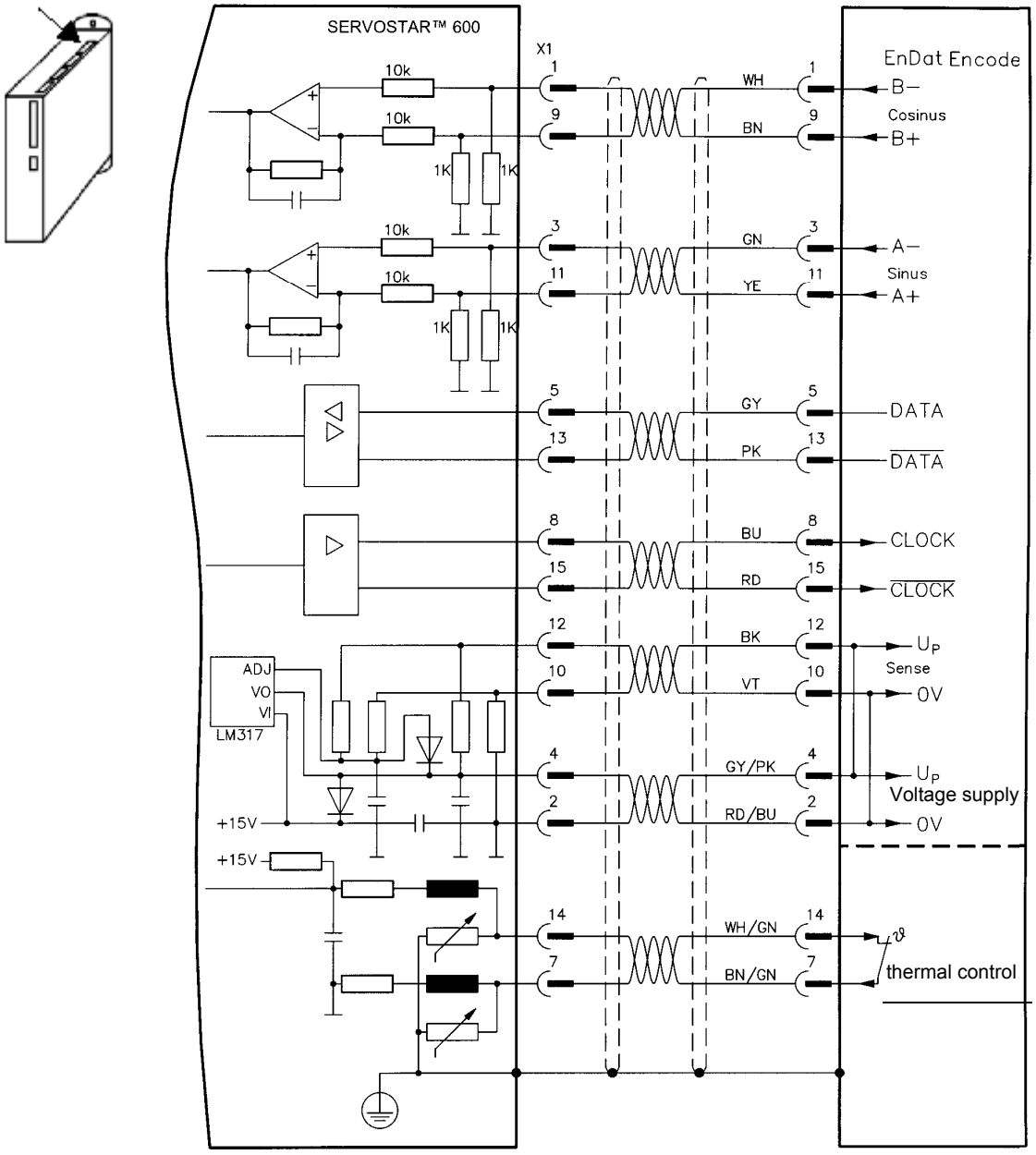


4.5.2 Encoder (X1)

The SERVOLINE® products are optionally available with a multiturn sine-cosine encoder.

This encoder is used by the servo amplifier as a feedback unit for drive tasks which require highly precise positioning or very good synchronism.

The thermal protection contact in the motor is connected via the encoder line to the servo amplifier and is evaluated there.



4.6 Control signals

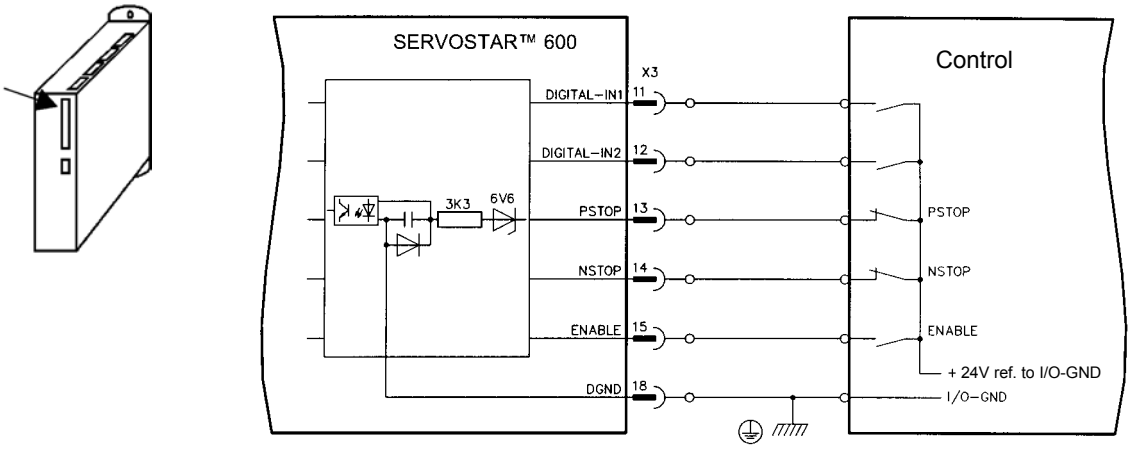
4.6.1 Digital control inputs (X3)

All digital inputs are separated by optocouplers and are potential-free relative to the servo amplifier.

- The logic is dimensioned for +24V / 7mA **(PLC-compatible)**
- High-level of +12...30V / 7mA, Low-level of 0...7V / 0mA

Technical data

Reference earth	Digital-GND (DGND, terminal X3/18)
Control inputs	24V/7mA, SPS compatible
	High-Pegel +12 ... 30V/7mA
	Low-Pegel 0 ... 7V/0mA
Plug	Combicon 5.08 / 18-pole, 2.5 mm^2
Line	Data up to 50 m long: 0. 5mm^2, not screened



4.6.1.1 ENABLE input

The output stage of the servo amplifier is activated by the enable signal. (terminal X3/15, input 24V, active-high). In the inhibited state (low signal), the motor which is attached does not have any torque.

4.6.1.2 Freely programmable digital inputs

You can use the digital inputs PSTOP / NSTOP / DIGITAL-IN1 and DIGITAL-IN2 to initiate pre-programmed functions that are stored in the servo amplifier.

A list of the pre-programmed functions has been provided in the operator software manual.

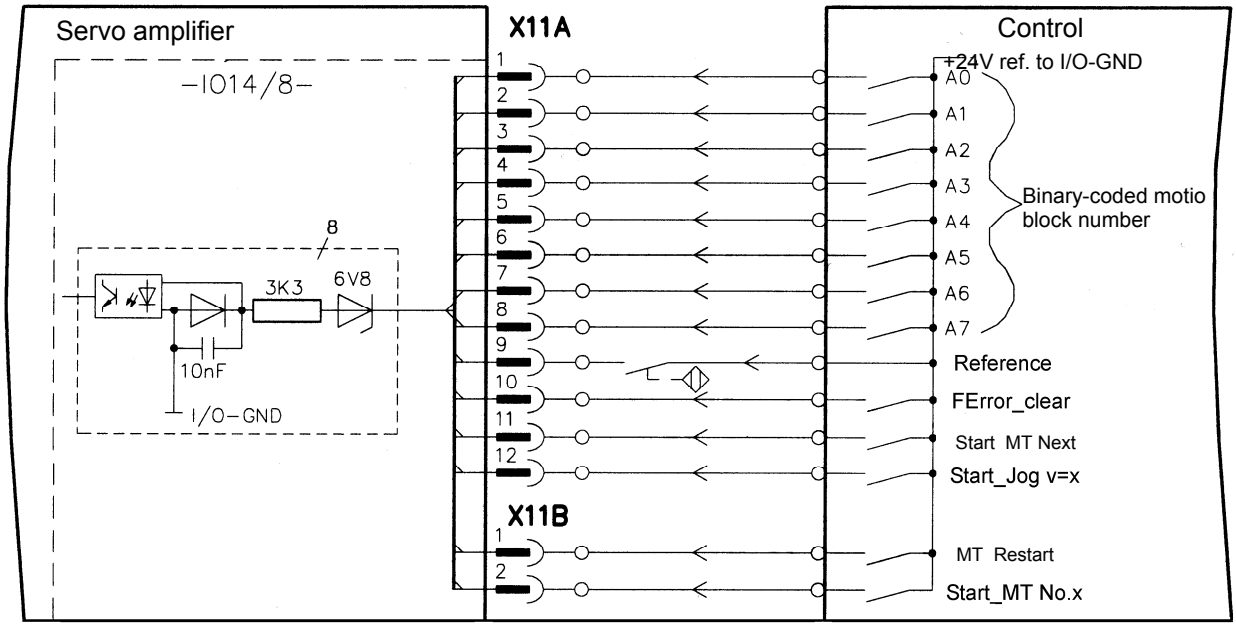
If an input is freshly assigned to a pre-programmed function, then the data set must be stored in the EEPROM of the servo amplifier, and the 24V auxiliary supply of the servo amplifier must be switched off and on again (to reset the amplifier software).

4.6.2 Digital control inputs (X11A resp. B)

Technical data

All digital inputs are separated by optocouplers and are potential-free relative to the servo amplifier.

Reference earth	I/O-GND (terminal XIIB/12)
Control inputs	24V/7mA, SPS compatible
Plug XIIA	Mini Combicon, 12-polig, coded on PIN1
Plug XIIB	Mini Combicon, 12-polig, coded on PIN12
Line	Data – up to 50 m long: 0.5 mm^2, not screened
Waiting time between 2 drive orders	Dependent on the response time of the control (PLC)
Addressing time (min.)	4 ms
Start delay (max.)	2 ms



4.6.2.1 Preset digital inputs

You can use the digital inputs X11A1 to X11B2 to trigger certain functions that are stored in the servo amplifier.

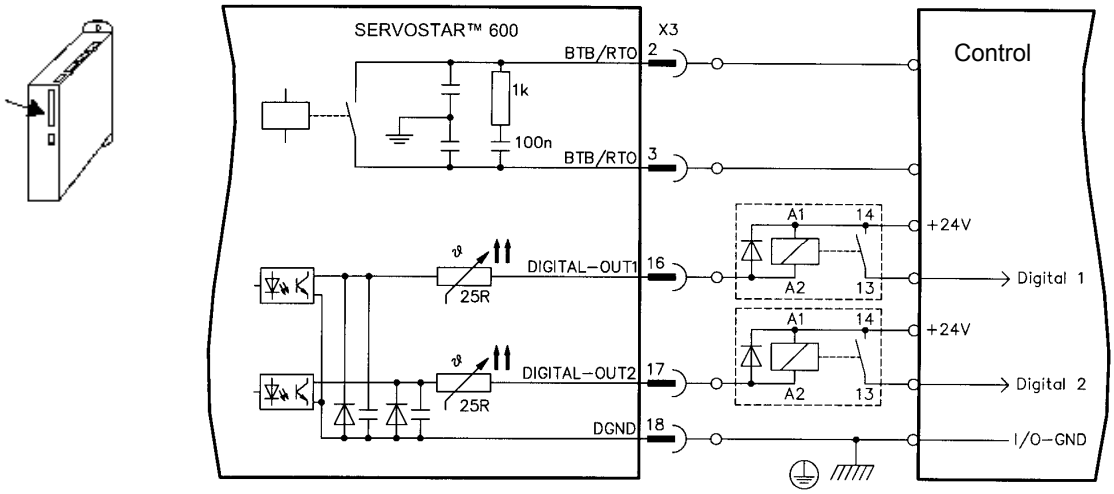
A list of the functions has been provided in the user manual of the operator software.

4.6.3 Digital control outputs (X3)

All digital inputs are separated by optocouplers and are potential-free relative to the servo amplifier.

Technische Daten

Reference earth	Digital-GND (DGND, Terminal X3/18)
DIGITAL-OUT 1 and 2	Open collector
BTB/RTO	Relay output, max. 24 VDC, 42VAC, 0, SA
Plug	Combicon 5.08 / 18-pin, 2.5 mm^2
Line	Data –up to 50 m long: 0.5 mm^2, not screened



4.6.3.1 Ready-to-operate contact BTB/RTO

Operational readiness (terminals X3/2 and X3/3) is signaled by a **floating** relay contact. The contact is **closed** when the servo amplifier is ready for operation, the signal is **not** influenced by the enable signal, the I^2t-limit, or the regen threshold.

All faults cause the BTB/RTO contact to open and the output stage to switch off.
A list of the error messages has been provided in the operator software manual.

4.6.3.2 Freely programmable digital outputs

You can use the digital outputs DIGITAL-OUT1 and DIGITAL-OUT2 to output messages from pre-programmed functions that are stored in the servo amplifier.

A list of the pre-programmed functions has been provided in the operator software manual.

If a pre-programmed function is assigned anew to an input, then the data set must be stored in the EEPROM of the servo amplifier, and the 24V auxiliary supply voltage of the servo amplifier must be switched off and on again (to reset the amplifier software).

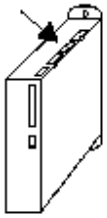
Evaluate the outputs via inverting interface relays (see connection diagram), for example Phönix DEK-REL-24/I/1 (turn-on delay 6 ms, turn-off delay 16 ms).

The described logic in the Setup Software manual refers to the output of the inverting interface relays. Consider the delay of the applied relay !

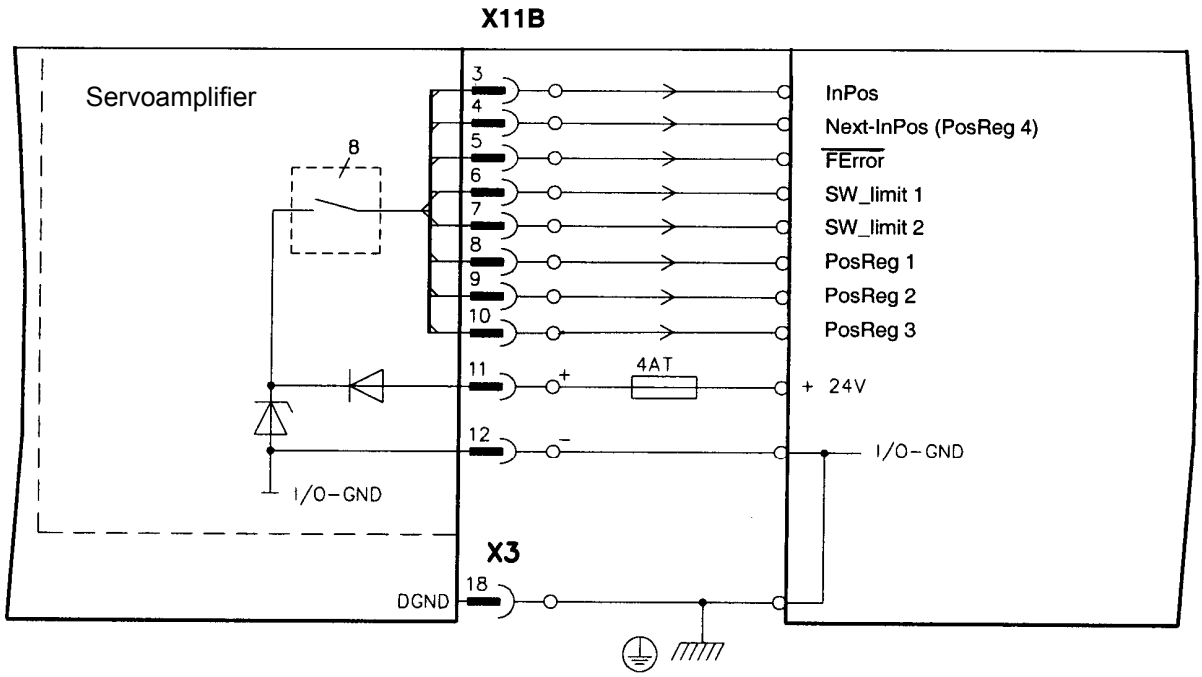
4.6.4 Digital control inputs (X11B)

The extension card XII is supplied with 24 VDC from the control. All digital outputs are isolated by optocoupler and are potential-free relative to the servo amplifier.

Technical data



Reference earth	I/O-GND (terminal X11B/12)
Detector output	24 V/max. 500 mA, PLC-compatible
Fuse (external)	4 AT
Plug	Mini Combicon, 12-pole, coded at PIN 12
Line	Data – up to 50 m long: 0.5 mm^2, unscreened Supply – 2 x 1 mm^2, note voltage losses



4.6.4.1 Preset digital outputs

You can use the digital outputs X11B/3 to X11B/9 to output certain signals that are stored in the servo amplifier.

A list of the functions has been provided in the user manual of the operator software.

4.7 Encoder emulation

4.7.1 Incremental encoder interface (X5)

The incremental encoder interface forms part of the scope of delivery. Use the encoder emulation function ROD (screen page «Encoder emulation»).

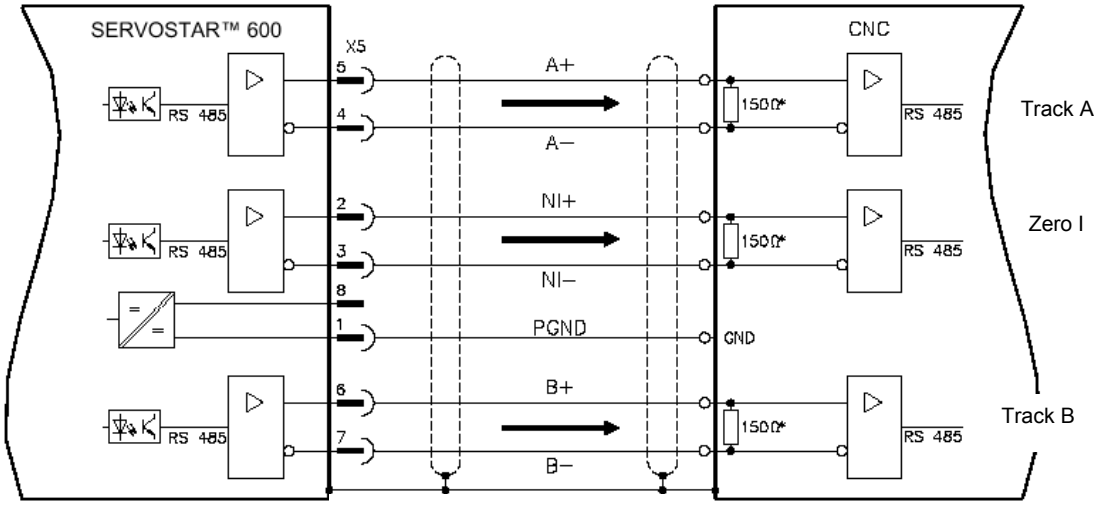
The position of the motor shaft is calculated in the servo amplifier from the absolute cyclic signals of the resolver. From this information, the incremental encoder-compatible pulses are generated.
At the SubD plug X5, pulses are output in two signals A and B electrically staggered by 90° and one zero pulse.

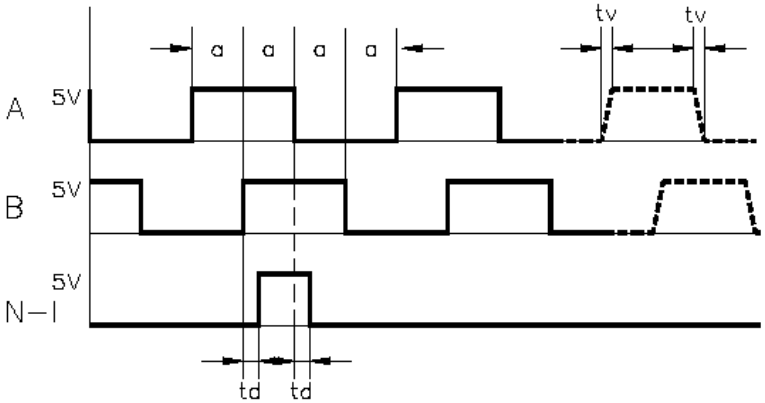
The resolution can be set with the parameter RESOLUTION in the Encoder emulation window:

256/512/1024 pulses/rev.	with feedback = resolver
2048/4096 pulses/rev.	with feedback = EnDat
8192 pulses/rev.	with feedback = EnDat up to 3000 min -1
16384 pulses/rev.	with feedback = EnDat up to 1500 min –1

The position of the zero pulse can be set within a mechanical revolution and stored (parameter NI-OFFSET). Owing to the compatibility with commercial pulse generators, the zero pulse can be set only for A=B=1.
The driver supply is provided by an internal voltage. PGND must be connected to the control in each case.

Connection and signal description for incremental encoder interface:





Flank spacing a ≥ 0.8 µs
U_H ≥ 2.0V/-20mA
U_L ≤ 0.5V/+20mA
Flank slope tv ≤ 0.1 µs
Delay N-I-td ≤ 0.1 µs
Scanning frequency > 160kHz
Limiting speed for electric encoder signals 6000min^{-1}

4.7.2 SSI interface (X5)

The SSI interface (synchronous serial absolute encoder emulation) forms part of the scope of delivery. Choose the encoder function SSI (screen page "Encoder emulation").

The position of the motor shaft is calculated in the servo amplifier from the absolute cyclic signals of the resolver. From this information, a position output compatible with the data format of commercial SSI absolute encoders is generated. At the SubD plug X5, this synchronous serial absolute cyclic 12-bit information is output.

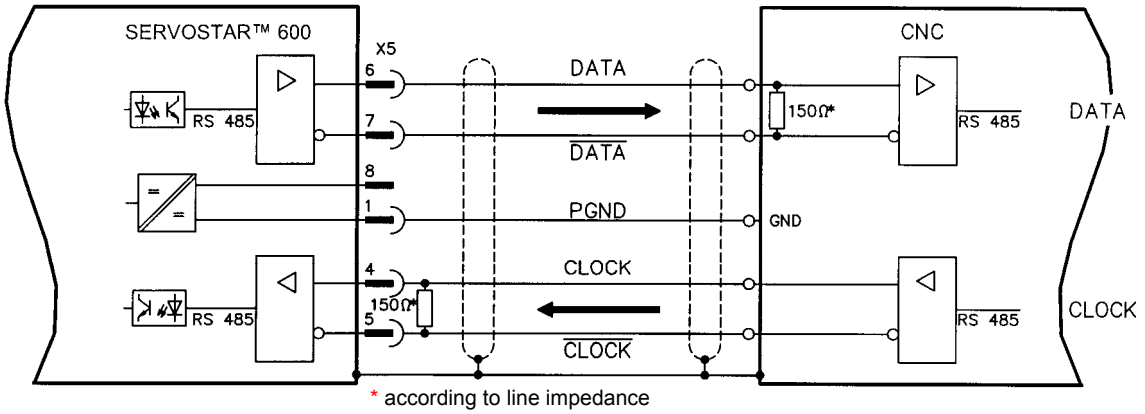
24 bits are transmitted; the upper 12 bit are set to ZERO and the lower 12 bit contain the position data.

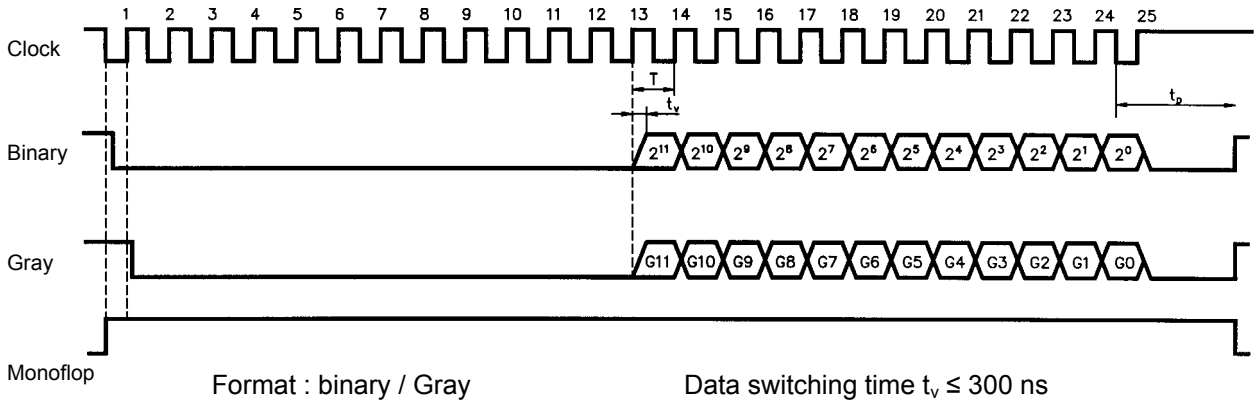
The interface must be read in by a multiturn encoder which also gives a valid single-turn data item. The signal sequence can be output in the Gray format (standard) or in binary format (parameter SSI-CODE).

A serial signal is read out synchronously by the control with the clock frequency (1.5 MHz). You can adapt the servo amplifier to the clock frequency of your SSI evaluation with the parameter SSI-CLOCK (200 kHz or 1.5 MHz and inverted).

The driver is supplied by an internal voltage.
PGND must be connected to the control in each case.

Connection and signal description for SSI interface:
The counting direction of the SSI interface is set to count incrementally when viewing along the motor axis with clockwise rotation.





Format : binary / Gray
Max. transmission rate = 1.5 Mbaud
Min. period T = 600 ns

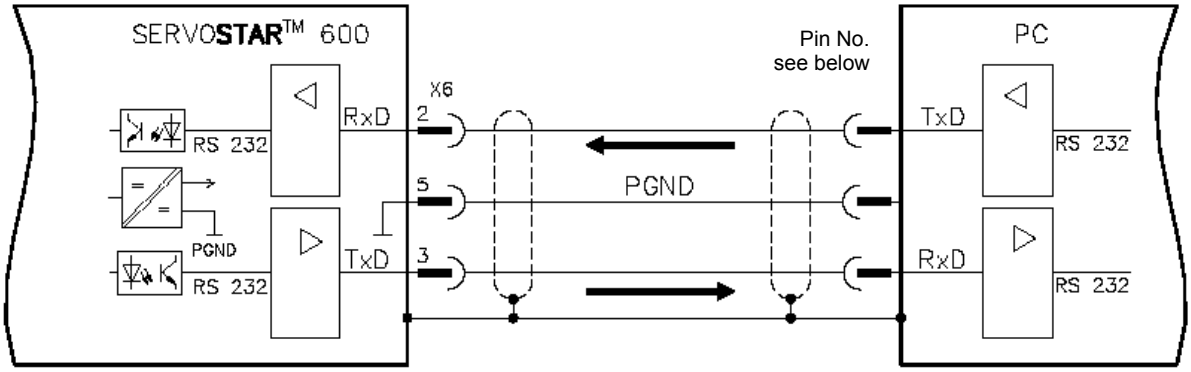
Data switching time $t_v \leq 300$ ns
Monoflop settling time $t_p < 15$ µs
$U_H \geq 2.0V/-20$ mA $U_L \leq 0.5V/+20mA$

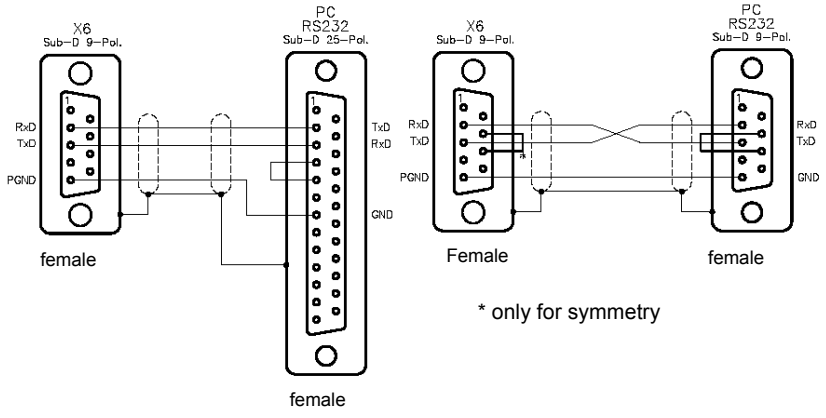
4.8 PC connection, RS232 interface (X6)

Setting the motion-block parameters can be carried out on an ordinary commercial PC.

Connect the PC interface (X6) of **the servo amplifier while the supply to the equipment is switched off** via a normal null-modem cable to a serial interface of the PC **(do not use a null-modem link cable!).**

The interface is electrically isolated through an optocoupler, and is at the same potential as the CANopen interface.

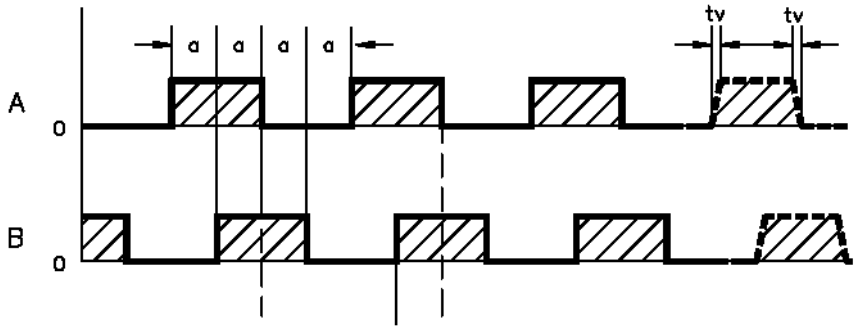




4.9 Interface for master-slave operation, encoder configuration (X5)

With the aid of this interface, you can interconnect several SERVOSTAR™ 600 amplifiers (master-slave operation). The slave amplifier is configured with the aid of the commissioning software (electrical gear). The resolution (number of pulses/revolution) is adjustable. AGND and DGND (terminal X3) must be bridged !

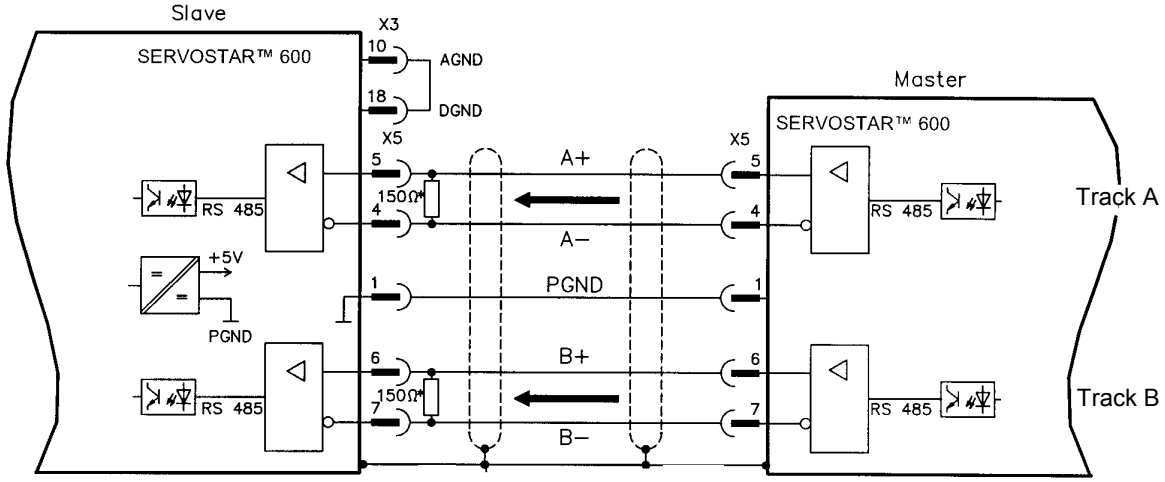
Signal diagram for encoder with RS422 output:



4.10 Connection to SERVOSTAR™ 600 master, 5 V level (X5)

With the aid of this interface, several SERVOSTAR™ 600 amplifiers can be interconnected (master-slave operation). Up to 16 slave amplifiers are actuated by the master via the encoder output. SubD plug X5 is used for this purpose.

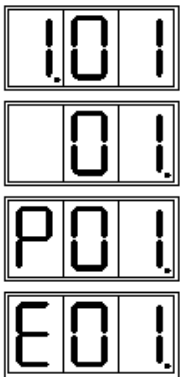
Limiting frequency: 1 MHz, flank slope tv < 0.1µs
AGND and DGND (terminal X3) must be bridged !



* according to line impedance (only once at end of bus)

5. LED display

5.1 Structure



Status 1: 24V switched on
unit indicates software version of the system software
after 1 sec. Shift to status 2, 3 or 4

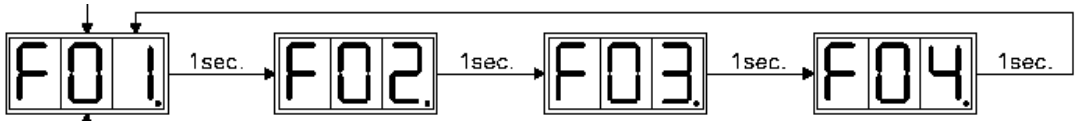
Status 2: 24V switched on
Unit indicates current (in this example 1A)
flashing dot

Status 3: 24V switched on, mains supply switched on
unit indicates current and mains supply on
flashing dot

Status 4: 24V switched on, mains supply switched on, unit enabled
unit indicates current and mains supply on and enabled
flashing dot

5.2 Error messages

All errors which occur are displayed in succession for 4 flashing cycles each.



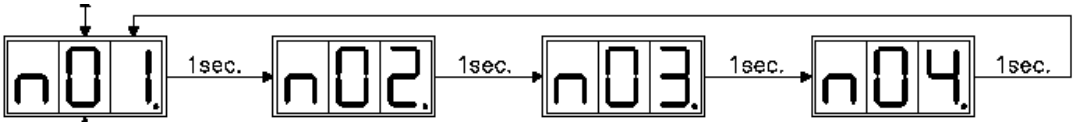
All error messages result in the following action: the BTB contact (terminals X3/2 and X3/3) opens; the drive switches off in a managed way (braking with emergency ramp); and the output stage of the amplifier switches off (motor loses all torque). The holding brake of the motor is activated (SVA-130 only).

Number	Designation	Explanation
F01*	Heat sink temperature	Heat sink temperature is too high Limit has been set to 80°C by the manufacturer
F02*	Overvoltage	Overvoltage in the DC-link circuit Limit depends on the mains supply voltage
F03*	Following error	Message from the position controller
F04	Feedback	Cable break, short-circuit, short to ground
F05*	Undervoltage	Undervoltage in the DC link Limit has been set to 100V by the manufacturer
F06	Motor temperature	Temperature sensor faulty or motor temperature too high Limit has been set to 145°C by the manufacturer
F07	Auxiliary voltage	Internal auxiliary voltage not OK
F08*	Overspeed	Motor running away, speed is higher than is permissible
F09	EEPROM	Checksum error
F10	Flash-EPROM	Checksum error
F11	Brake	Broken cable, short-circuit, short to ground (SVA only)
F12	Motor phase	Motor phase is missing (broken cable or similar)
F13*	Internal temperature	Internal temperature in the amplifier is too high
F14	Output stage	Fault in the power output stage
F15	I²t max.	I²t max. value exceeded
F16*	Mains BTB	2 or 3 supply phases are missing
F17	A/D converter	Error in the analog-digital conversion
F18	Regen	Regen circuit faulty or setting incorrect
F19*	Mains phase	A supply phase is missing
F20	Slot error	Hardware error on the expansion card
F21	Handling error	Software error on the expansion card
F22	Earth fault	Inactive
F23	CAN bus inactive	Communication interrupted by CAN bus
F24-F31	Reserved	Reserved
F32	System fault	System software not responding correctly

* = These error messages can be cleared without resetting the amplifier. If only one of these errors is present and the RESET button or the I/O function RESET is used, then too, only the error is cleared.

5.3 Warnings

All warnings which occur are displayed in succession for 4 flashing cycles each.



Faults that occur but do not cause a switch-off of the amplifier output stage (BTB contact remains closed) are displayed as a numerical warning code in the LED display on the front panel and on the screen page “STATUS”. Warnings that are recognised by the supply monitoring system will only be reported after the servo amplifier has been enabled.

Number	Designation	Explanation
n01	I²t	I²t message threshold exceeded
n02	Regen power	Preset regen power reached
n03*	FError	Preset following error window exceeded
n04*	Response monitoring	Response monitoring (field bus) active
n05	Mains phase	Mains phase missing
n06*	SW limit switch 1	Software limit switch 1 exceeded
n07*	SW limit switch 2	Software-limit switch 2 exceeded
n08	Motion task_error	A faulty motion task was started
n09	No reference point	No reference point set at start of task
n10*	PSTOP	Hardware limit switch PSTOP activated (servo axes without hardware limit switch)
n11*	NSTOP	Hardware limit switch NSTOP activated (servo axes without hardware limit switch)
n12	Default values	Inactive
n13	Expansion card	Expansion card not functioning correctly
n14	HIPERFACE®	Inactive
n15	Table error	Inactive
n16-n31	Reserved	Reserved
n32	Firmware beta version	Firmware version has not been released
A	Reset	RESET is present at DIGITAL IN1

* = These warning messages lead to a controlled shut-down of the drive (braking with the emergency ramp)

6. Elimination of faults

The following table provides some tips to enable you to eliminate errors. Depending on the system and the number of servo axes which you are operating, there may be hidden causes of errors. In case of doubt, please contact us.

No.	Error	Possible cause of error	Measures for eliminating causes of errors
F01	Error message Heat sink temperature	Permissible heat sink temperature has been exceeded	Improve ventilation
F02	Error message Overvoltage	• Mains voltage too high	Use mains transformer
F03 n03	Following error`	• Reference switch incorrectly connected • Mechanical load too high	Check reference switch Reduce dimensions and/or loading moment
F04	Error mesage Feedback unit (resolver or encoder)	• Feedback plug has not been correctly connected • Feedback cable is broken, crushed, etc.	Check plug connector Check cable
F05	Error message Undervoltage	• Mains voltage not present or too low when servo amplifier is enabled (enable ON)	Enable servo amplifier only when the mains voltage has been switched on. Delay > 500 ms. (See Section 2.1)
F06	Error message Motor temperature	• Plug of feedback unit (resolver or encoder) loose or feedback cable broken	Screw plug tightly or use new feedback cable
F07	Error message Auxiliary voltage	• The auxiliary voltage generated in the servo amplifier is incorrect	Replace servo amplifier
F11	Error message brake	• Short-circuit in the voltage supply cable of the motor holding brake • Faults on the brake cable • Faulty motor holding brake	Eliminate short-circuit Check screen of brake cable Replace motor
F13	Error message Internal temperature	• Permissible internal temperature exceeded	Improve ventilation
F14	Error message Output stage error	• Output stage module overheated • Faulty output stage module • Motor cable has short-circuit or earth fault • Motor has a short-circuit or earth fault	Improve ventilation Replace servo amplifier Replace motor cable Replace motor
F15 n01	Error message I^2t max.	• Reference switch incorrectly connected • Servo axis travels towards obstacle Mechanical load too high	Check reference switch Check setup Reduce dimensions and/or loading moment
F16	Error message mains BTB	• Controller was enabled although no mains voltage was present • At least 2 mains phases absent	Enable servo amplifier only when the mains voltage has been switched on (see Section 2.1) Check mains supply
-	Motor does not turn	• Servo amplifier not enabled • Feedback cable (resolver or encoder) broken • Motor cable incorrectly connected (multiple axes) • Motor phases interchanged • Brake has not released • Servo axis is mechanically blocked	Apply enable signal Check feedback cable Check motor cable Wire motor phases correctly Check brake actuation Check mechanical system
-	Motor oscillates	• Screen of feedback cable (resolver or encoder) broken • Wrong data record loaded (multiple axes)	Replace feedback cable Load correct data record

7. Spare parts list

Item	Designation	Art.No.	Supplier	Material
	Digital servo controller	506152	Seidel Servo Drives GmbH	Various
	Connector set for servo controller	506416	Seidel Servo Drives GmbH	Various
	Resolver cable	506156	Seidel Servo Drives GmbH	Sheath insulation: PUR polyurethane, 11Y Core insulation: PETP polyesteraphtalate, 12Y
	Motor cable	506155	Seidel Servo Drives GmbH	Sheath insulation: PUR polyurethane, 11Y Core insulation: PETP polyesteraphtalate, 12Y
	User manual german	507019	Montech AG	Paper
	User manual english	507020	Montech AG	Paper
	User manual french	507021	Montech AG	Paper
	User manual italian	507022	Montech AG	Paper
	User manual spanish	507023	Montech AG	Paper
	User manual swedish	507024	Montech AG	Paper

8. Appendix

8.1 Abbreviations and acronyms

The table below shows abbreviations and acronyms used in this manual

Abbreviation / acronym	Explanation
AGND	Analogue ground
BTB/RTO	Ready for operation
CE	Communité Européenne (European Community)
CENELEC	European electrotechnical standards coordinating committee
CLK	Clock (clock signal)
COM	Serial interface of a PC-AT
DGND	Digital ground
DIN	German technical standards organisation (Deutsches Institut für Normung)
Disk	Magnetic storage (diskette, hard disk)
EEPROM	Electrically erasable and programmable read-only memory
EMC	Electromagnetic compatibility
EN	European standard
ESD	Electrostatic discharge
IDC	Analogue current monitor
IEC	International Electrotechnical Commission
IGBT	Insulated Gate Bipolar Transistor
INC	Incremental interface
ISO	International Standardisation Organisation
LED	Light Emitting Diode
MB	Megabyte
MS-DOS	Operating system for PC-AT
NI	Zero impulse
NSTOP	Limit switch input, anticlockwise rotation
PELV	Protective low voltage
PGND	Ground of the interface used
PSTOP	Limit switch input, clockwise rotation
PWM	Pulse width modulation
RAM	Volatile memory
Rballast	Ballast resistance
Rbext	External ballast resistance
Rbint	Internal ballast resistance
RES	Resolver
SPS	Programmable logic controller PLC
SRAM	Static RAM
SSI	Synchronous serial interface
SW/SETP.	Sollwert (setpoint)
UL	Underwriter Laboratory
V AC	Alternating voltage
V DC	Direct voltage
VDE	Association of German electrical engineers
VGA	Graphic output with min. 640x680 pixels
VTA	Analogue speed monitor
XGND	Ground of the 24 V supply voltage

8.2 Glossary

E	EEPROM	**E**lectrically **E**rasable and **P**rogrammable **R**ead-**O**nly **M**emory Electrically erasable memory in the servo amplifier. Data stored in the EEPROM is not lost when the auxiliary voltage is switched off.
	E^2PROM	See EEPROM
	Enable	Enable signal for the servo amplifier (+24)
	Ipeak, peak current	Effective value of peak current
	Irms, effective current	Effective value of continuous current
	Reset	Restart of the micro processor
	ROD interface	Incremental position output
C	Current controller	Controls the difference between current setpoint and actual value of the current to 0.
G	GRAY format	Special form of binary code (with only one bit changing between sequential numbers)
H	Holding brake	Motor brake which must only be applied with the motor at a standstill.
I	I^2t	Monitoring of the effectively required root-mean-square (RMS) current
I	Intermediate circuit	Rectified and smoothed output voltage
M	Motion block	Data packet with all position control parameters which are required for a motion task.
O	Optical coupler	Optical connection between two electrically independent systems
P	Position controller	Controls the difference between position setpoint and actual value to 0.
R	RAM	**R**andom **A**ccess **M**emory Volatile memory in the servo amplifier. Data stored in RAM are lost if the auxiliary voltage is switched off.
S	SSI interface	Cyclically absolute serial position-output
Z	Zero pulse	Is issued once per revolution by incremental transmitters; it is used for zeroing the machine.

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